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January, 1956

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An Important Message

The Environmental Equipment Institute is organized by and for everyone interested in environmental testing and simulation. There are three distinct groups who share this common interest: those who manufacture environmental equipment, those who manufacture associated equipment and components, and those whose interest is primarily in the uses of the equipment. Corresponding to the various degrees and kinds of interests of these groups we have three classes of membership: Manufacturing, Associate, and Science Members.

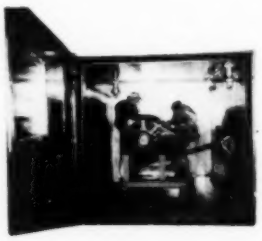
The fact that the Institute was founded by the Manufacturing Members has caused some apprehension on the part of many who should be actively participating in its affairs. They feel, apparently, that the organization is suspect because its founders have a commercial interest in the field. Let's face this issue frankly, because it is important to the future of the Institute. There is no point in dodging the fact that the Manufacturing Members stand to gain from enhanced interest in environmental simulation and testing. There is nothing wrong about that. Every company must be in business to make a profit, and is bound to do all that it can to foster its chances to do so. Most users of environmental equipment work for companies who have the same objective, albeit in a different field.

Actually, the extension of the activities of the Institute to include the Science Section can be considered only as a remarkable example of enlightened self-interest and industrial statesmanship. No forum has existed, up to this time, where engineers and scientists can discuss the many problems of the field. Someone had to take the initiative, and the manufacturers did it. Although their action is unusual, it is not unique. The automobile manufacturers heavily subsidize the professional society serving its engineers, and the society has a highly respected professional status. Many other examples could be cited of industries which support the technical societies which provide intellectual stimulus to their professional and technical personnel. The unusual part of this action is that it has been taken by the group least able to do so. From the point of view of size and financial resources, the manufacturing members are small, compared with a great many of the companies using their equipment. Although the budget of the Institute has never been adequate, in terms of the contributions of individual manufacturing members it has been generous.

The program of the Institute is not over-ambitious. The only real criticism is that it is moving too slowly, but it can only move as fast as funds will permit. Nevertheless, the achievements are noteworthy. This "Quarterly," for example, is the only publication devoted to environmental problems. The First Annual Science Meeting was acclaimed by all who attended, and the Procedings of that meeting have been described as "The greatest amount of material on environmental testing ever to be published at one time." The Second Annual Science Meeting will be even more impressive than the first.

But the Institute requires the backing of all three classes of membership – not just one or two interested groups. Individual engineers and scientists, whether independent or affiliated, are urged to take advantage of the benefits of membership in the Institute and to subscribe to the "Quarterly". The Science Members must not lag behind the others in making our program successfully self-sustaining. Join the Institute today! It exists for your benefit and deserves your support!

GEORGE D. WILKINSON
General Manager



The Cover

Flight Refueling, Inc., Baltimore, Md., uses this 7' x 7' x 7' altitude, temperature and humidity chamber for testing its probe-and-drogue refueling system under world wide operating conditions. Equipment on stand is hose reel unit.

The chamber (by Tenney) has facilities to handle the flow of fuel into a complete refueling unit at the rate of hundreds of gallons a minute.

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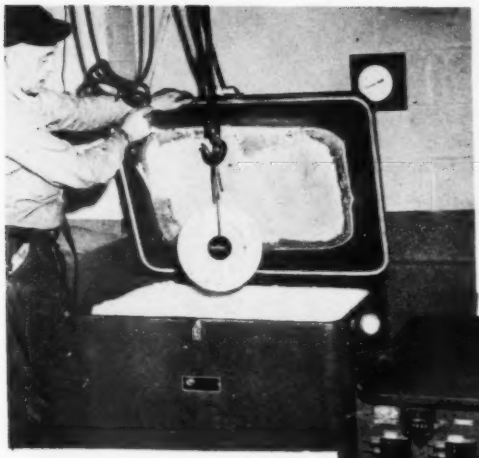

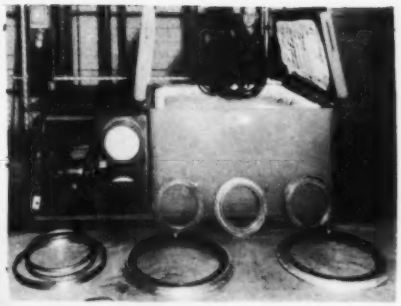

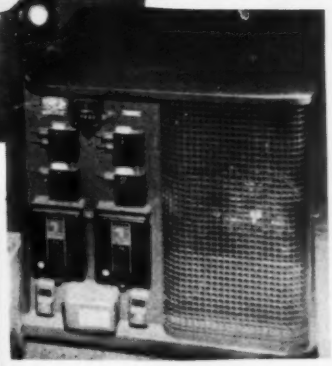

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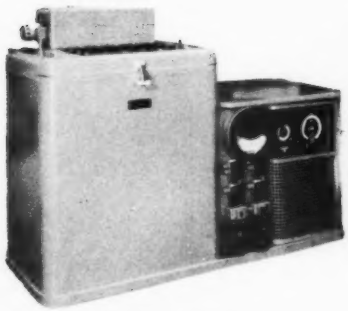

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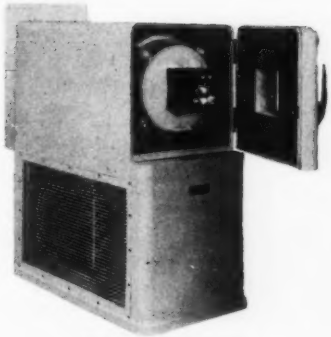

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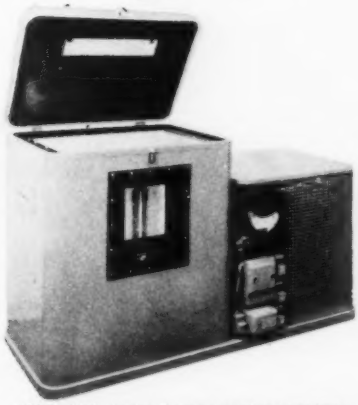

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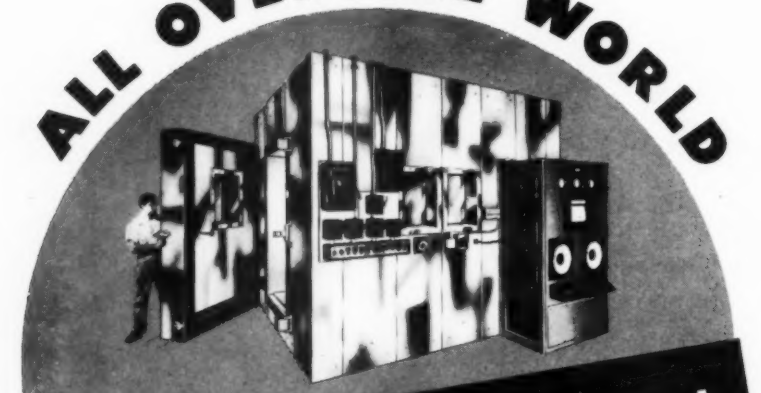

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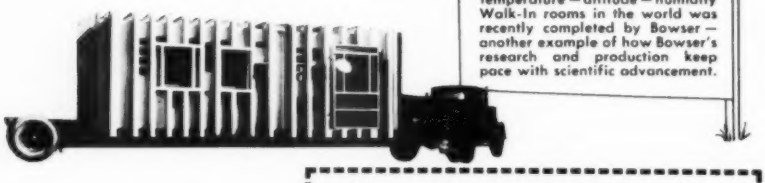

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One of a series of current advertisements appearing in Aviation Age, Electronics, Industrial Laboratories and Instruments.

LETTERS TO THE EDITOR

We were very much impressed with the initial issue of the *Environmental Quarterly* and we wish you success in your venture.

The Commissary Research Division of this Facility performs environmental tests on equipment items and our personnel have expressed interest in membership in the Environmental Equipment Institute. We would appreciate further information and application blanks as mentioned on page 14 of the *Environmental Quarterly*.

L. E. Anderson, Jr., Lieutenant Commander
U. S. Naval Supply Research and Development Facility

On behalf of Mr. E. R. Kaiser, Director of Research of the American Society of Heating and Air-Conditioning Engineers, I would like to congratulate you on a splendid first issue of *Environmental Quarterly*.

We intend to subscribe to your magazine and are very interested in the aims and ambitions of the institute.

We would appreciate it if you could give us some information on how the institute was formed, its scope, etc. Again, congratulations to you and your staff.

(Mrs.) Noreen Falasca, Librarian
American Society of Heating and Air-Conditioning Engineers, Inc.

I have had the opportunity, recently, to review your first issue of the *Environmental Quarterly* and am quite impressed with its application to my type of work.

I am a mechanical engineer with the Sandia Corporation and have the responsibility of performing natural and accelerated tests for the Quality Assurance Organization.

Please send me an application blank and any brochures which you may have for distribution to prospective members.

Joseph M. Ralls
Albuquerque, New Mexico

2nd ANNUAL MEETING for the SCIENCE SECTION of the ENVIRONMENTAL EQUIPMENT INSTITUTE

WHERE?	Sheraton Hotel, Chicago, Ill.
WHEN?	April 19 and 20, 1956
WHAT?	Four Seminars on vibration and climatic testing
	Eight Papers covering various phases of environmental testing
	Four Facility Trips to Armour Research and Inland Testing Labs
	One Film describing the Mount Washington Icing Facility
HOW?	Contact H. F. Sander, Meeting Chairman, c/o Vapor Heating Corp., 6420 W. Howard St., Chicago 31, Ill. for advance Program and Registration Blanks

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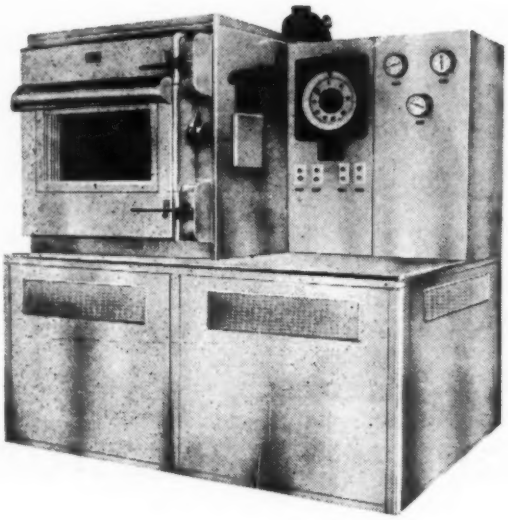

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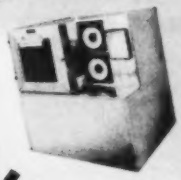

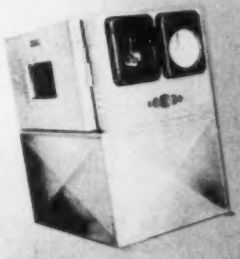

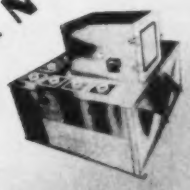

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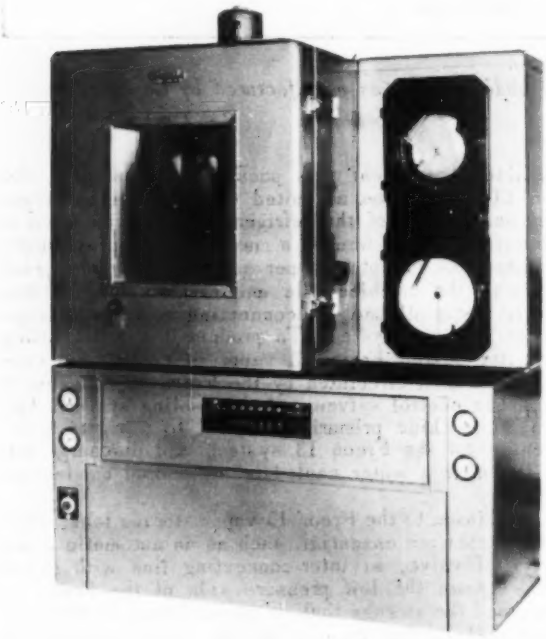
Freon 13 - Freon 22 Cascade Systems

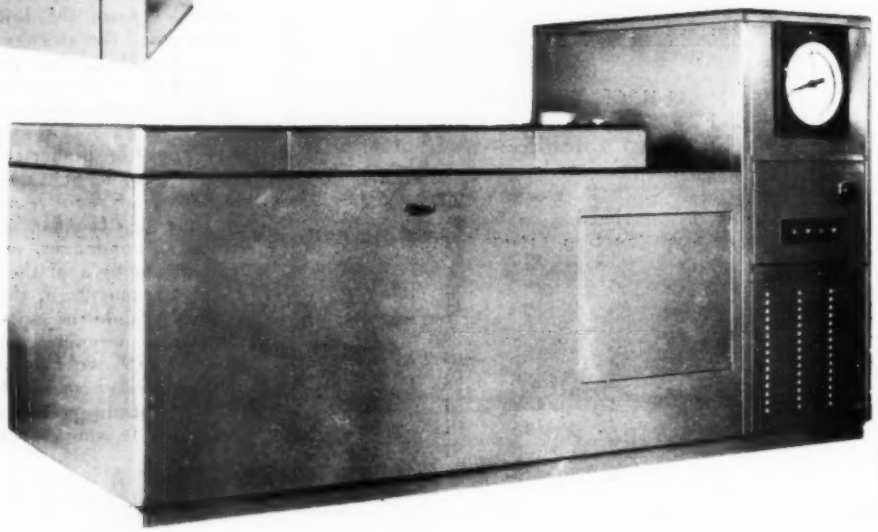
BY CHARLES F. CONRAD
CONRAD, INC., HOLLAND, MICHIGAN

During World War II, an urgent need for research and quality control presented itself, especially as related to equipment subjected to arctic, tropical and flight conditions. To answer this need and to permit testing at the point of manufacture, self-contained environmental test chambers were developed. Due to the lack of suitable materials, prior experience, and the urgent need for the equipment, many chambers were produced to meet the specific requirements with limited materials. Freon 22 refrigerant was employed, along with Freon 12, for cooling most of the chambers. Temperatures to -65F were produced without too much of a problem. Temperatures to -100F, or colder, were developed on some installations by means of compound compression systems, which, due to their inefficiency, required compressors three to five times as large as might be expected.

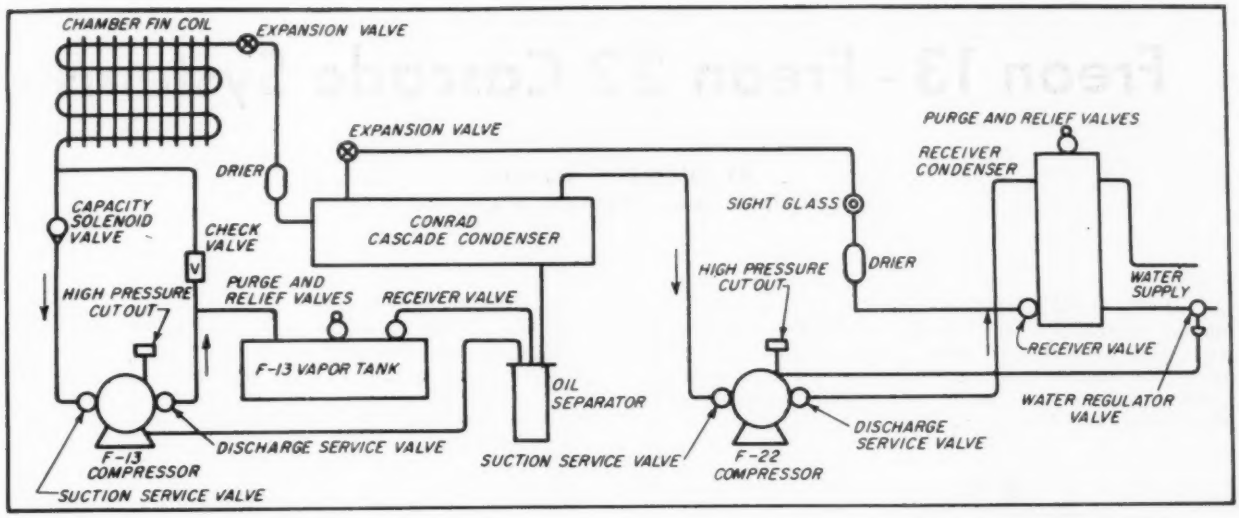
Some small chambers were produced employing a cascade refrigeration system, with Ethane and Propane coolants. Ethylene was also used as a refrigerant for a few installations. These refrigerants presented some problems relating to flammability hazard and leak detection, as well as service and repair difficulties.

Since chambers operating at -90 to -100F required that the intake pressure to the compressor be approximately 26" to 28" of vacuum gauge pressure, the displacement required per unit of cooling was greatly increased and the potentiality of moisture being drawn into the system, should any leakage develop, was very serious. Additionally, oils and lubricants had not developed which were satisfactory at low temperatures. Ideally, a low temperature refrigerant should be able to produce temperatures to -100F without operating the compressor in a vacuum. The E. I. du Pont de Nemours Company worked on this problem, and in 1945 developed Freon 13 and Freon 14 refrigerants, both of which are non-flammable and non-toxic. Freon 13 refrigerant has a





Above is Conrad Model No. FD–8–2–2 chamber having a temperature range of 250F to-100F. It uses Freon 13- Freon 22 in its 2 hp compressors. At right is Conrad model No. CB–45–705–5, another Freon 13–Freon 22 chamber, having a range of Ambient to-140F.



Schematic shows a typical layout of a Freon 13–Freon 22 cascade system, as manufactured by Conrad, Inc.

temperature of approximately -114F at zero pounds gauge pressure. Freon 14 has a refrigerant temperature of -198F at zero pounds gauge pressure. Therefore, for applications relating to environmental test chambers, Freon 13 is most adaptable.

Freon 13 – Freon 22 cascade systems permit numerous advantages to the designer as well as to the user of an environmental test chamber. Primarily, this is because they allow for more compact installations, application of hermetically sealed or semi-hermetically sealed refrigerating systems, improved cooling rates, and colder temperatures with less total horsepower required. One major problem relating to the use of Freon 13 is the consideration that at room temperature conditions, a container with any liquid Freon 13 in it would have approximately 535 pounds per square inch gauge pressure. Since refrigeration equipment of conventional manufacture is not designed for such high pressures, methods must be utilized to prevent this possibility. Basically, the Freon 13 system has a limited vapor pressure charge, which permits all of the refrigerant to be contained in the system in vapor form at a maximum of approximately 150 pounds to 175 pounds per square inch gauge pressure, with the machine idle and at room temperature. This is accomplished by connecting a vapor storage chamber into the system. To produce the refrigerating effect, the stored Freon 13 vapor is cooled and condensed and then circulated by the Freon 13 compressor through the control valves and the cooling system. The Freon 22 machine primarily is used to refrigerate the condenser for the Freon 13 system, and discharge the heat to either a water cooled or air cooled condenser.

CHART OF AVERAGE TIME-TEMPERATURE-PRESSURES FOR 4 CU. FT. TEST CHAMBER (TWO HP UNITS) FREON 13 AND FREON 22 CASCADE SYSTEM

		Guage Pressures			
Chamber Temperature Pump Down	Time	F-13 Suction 0#	F-13 Head 210#	F-22 Suction 0#	F-22 Head 130#
200F	(Idle)	150	150	130	130
200F	Start	25	175	20	155
175F	2 min	20	165	20	155
110F	5	15	165	18	155
50F	10	15	165	18	155
-40F	25	14	150	18	155
-65F	30	12	145	15	155
-85F	35	10	140	10	155
-100F	40	4	135	6	155

In addition to the Freon 13 vapor storage tank, other safety factors are essential, such as an automatic pressure relief valve, an inter-connecting line with check valve between the low pressure side of the Freon 13 system and the storage tank to permit Freon 13 from the cooling coils to find its way into the vapor storage tank regardless of the position of compressor service valves. A high pressure limit switch is also recommended to stop the Freon 13 compressor at any time the discharge pressure might be higher than normal. A vent or purge valve should also be installed at the high point in the Freon 13 system or vapor receiver tank.

Through the use of Freon 22 refrigerant to cool the Freon 13 condenser, pressure relations are ideal for efficiency in both of the systems. For example, at -100F cabinet temperature, the return pressure of the Freon 13 system should be approximately zero poinds and the discharge pressure approximately 100 pounds to 125 pounds, with the Freon 22 system having approximately zero pounds pressure on the return line, and 150 pounds to 175 pounds pressure on the discharge side, if the condenser is water cooled.

Continued on Page 18

Electronic Test Facilities in Canada

BY A. P. HARRIS
CANADIAN MILITARY ELECTRONICS STANDARDS AGENCY

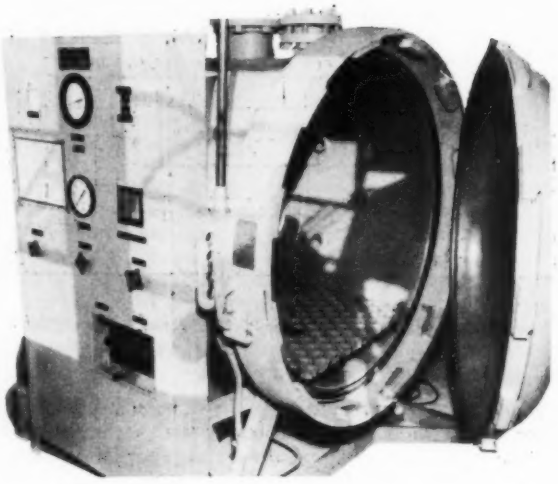
In Canada, the testing of parts manufactured for the military is assigned to the Canadian Military Electronics Standards Agency.

Both "qualification" and "evaluation" testing are carried out, the term qualification testing denoting use of standard military specifications and evaluation testing indicating there are no military specifications and that testing is done to meet standard environmental test requirements. Successful completion of the former leads to "qualification approval" whereas the latter leads to "limited approval".

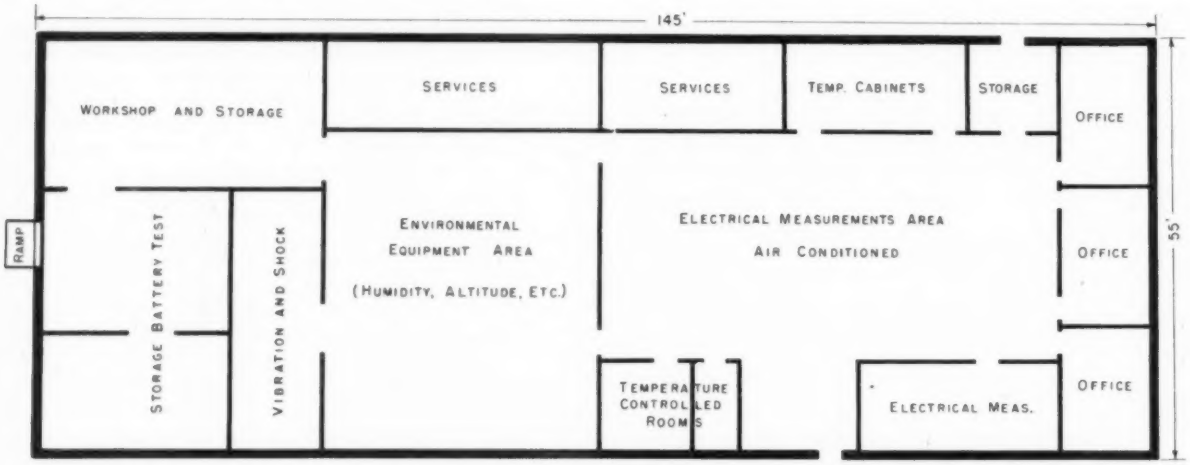
The Agency itself performs no tests but arranges by yearly contracts for suitable laboratory facilities, having determined the following to be essential to proper laboratory operation.

First, since more testing projects arise directly from equipment contracts, there is a time element involved and parts must be tested within a fixed period. The cost involved in holding up a large contract can be very large in comparison to the cost of testing or providing every facility needed for test. The laboratory must, therefore, be efficiently operated. This time element is a major factor in determining the character of the parts-testing laboratory. It changes the laboratory from a leisurely research type operation into a production-line facility.

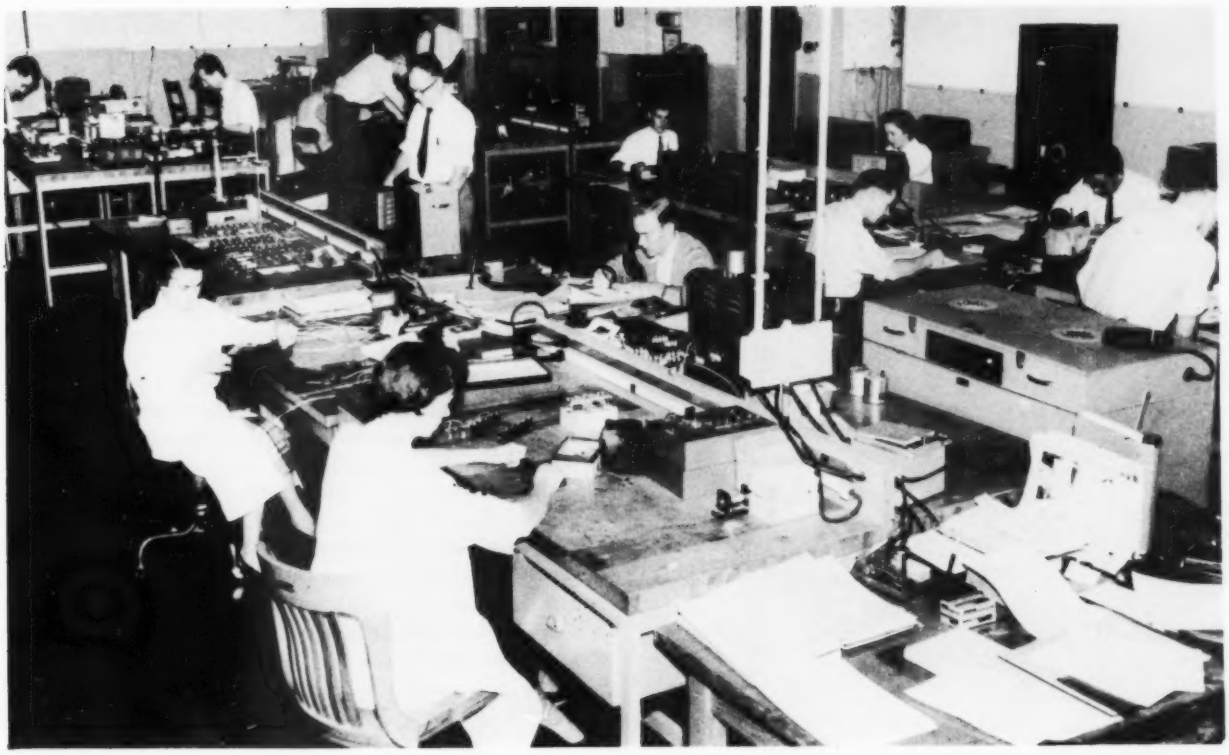
Second, the laboratory must have diverse facilities, capable of a wide range of testing. The parts and materials used in modern electronic gear are legion. There are up to 2000 separately classifiable items in certain airborne equipments. Besides many variations of the same class of items, there are at least 150 classes. In addition to conventional resistors and capacitors, therefore, the lab may be called upon to test motors, relays, batteries, crystals, magnetic recording tapes, or



Vibration and shock area of Canadian test laboratory includes this butane-type explosion testing machine.



Floor plan of Hydro Electric Power Commission's electrical measurements and environmental testing areas.



The electrical measurements area, shown in general view, contains a variety of test equipment for electrical parts.

other units involving measurement techniques and procedures with no similarity whatever. Materials alone can vary from rigid laminates through cords and tapes to varnishes.

Third, equipment must be suitable for the purpose. This obvious statement has several implications.

A busy laboratory working on many testing projects simultaneously requires the greatest flexibility in equipment. This normally rules out the use of multi-purpose environmental equipment unless a dual condition test is called for by the specification. For example, a combined temperature and altitude-humidity cabinet is not practical. Temperature tests cannot be delayed the two weeks required for normal humidity exposure and conversely humidity tests which start on fixed days in the week cannot wait completion of temperature tests. Scheduling with multi-purpose cabinets becomes well nigh impossible.

Equipment must be carefully balanced between electrical and environmental. Many laboratories are overburdened with oversize environmental chambers which are in service only a small fraction of the time while technicians wade through hundreds of routine measurements on inadequate electrical apparatus.

It must be remembered that usually an environmental exposure test by itself means nothing unless extreme mechanical degradation takes place. The purpose of environmental tests is to determine the effect on the electrical parameters. Electrical measurements are, therefore, the basic data for engineering judgment.

Fourth, the laboratory must be set up for one function only. For efficient operation there cannot be two competing demands on staff and equipment. If the laboratory is going to test components on a fairly large scale it cannot simultaneously engage in more leisurely research and development investigations.

One laboratory which the agency feels meets all of these requirements as well as providing a high calibre staff is the Research Division of the Hydro Electric Power Commission of Ontario. The Research Division provides the Agency with a materials laboratory in one area and an electrical and electronic laboratory in another. The operation described in this paper is limited to the electrical and electronic phase.

Since 1942 the laboratory has gone through several minor and two major expansions until the current test area is 7500 sq. ft.

The laboratory occupies an industrial type building approximately 55 to 150'. The roof is supported by trusses leaving a clear floor-area without centre bearing partitions. Where required, the floor is concrete. Insulation and sealing are provided to accommodate the air

The mechanical vibration machines have special base mountings which do not require treatment of floors.

conditioning system as well as the Canadian climate. Windows are sealed and double glazed in the conditioned area.

ELECTRICAL MEASUREMENTS AREA

The centre area is for electrical measurements and is air-conditioned to maintain a normal temperature of 72F with a relative humidity of 50%. The offices at the end are incorporated in the air-conditioned area. In this section are all standards, bridges and test sets used for measuring all conceivable electrical parameters. This area also is used for long term storage of components under normal fixed conditions to determine aging effects.

The air conditioning of this area is primarily for technical reasons. For example, there are several common measurements such as insulation resistance which are very susceptible to relative humidity and consistent measurements are impossible in relative humidities over 70%. The air conditioning also removes the temperature coefficient from all standards and bridges used in making precision measurements.

With some bridges capable of indicating 6 or 7 significant figures and with some test sets having a sensitivity of temperature coefficient of one part per million the necessity for conditioning is further apparent.

Also in this area are two temperature controlled rooms operating from 25 to more than 70C. These rooms are used to life-test parts at elevated temperatures. Life tests are common to all parts and the quantity of items necessitates a conditioned area of this size.

ENVIRONMENTAL EQUIPMENT AREA

The second largest floor area is allocated for the equipment producing various environments and includes humidity, temperature, altitude and explosion test equipment.

Certain mechanical life test equipment is included in this area for convenience. Air conditioning here is obviously not a necessity.

VIBRATION AND SHOCK AREA

The third main section of the laboratory is the area which includes most of the mechanical (and noisy) equipment. In this area are the mechanical vibration tables mounted on bases which do not require special floor treatment. Two sand-box drop-type shock testers and a MIL-S-901 shock machine (the lightweight version) are in this area together with a 25-lb rotary accelerator.

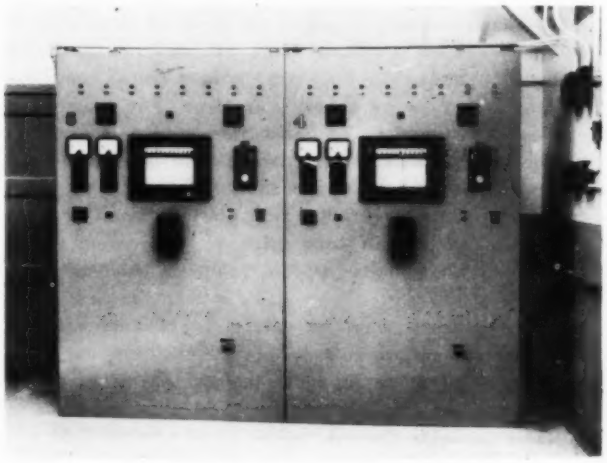
Elsewhere in the building is the high frequency vibration machine.

BATTERY TEST AREA

Behind the durability room is a special test area for batteries, principally storage types. This area includes a temperature controlled room with racks for the test samples kept at 80 ± 2F. Leads are fed through the walls to the control panels. These panels control automatically the charge and discharge rates and can perform standard life tests with a minimum of attendance.

WORKSHOP, STORAGE AND SERVICES

The number of mechanical jigs and fixtures required to set up tests is such that an elementary work-



Automatic panels for testing storage-type batteries perform standard life tests with minimum attendance.

shop is a very desirable feature. This workshop has both metal and wood-working machines. Storage is provided for all tested samples which are held two months before disposal.

TYPES OF EQUIPMENT

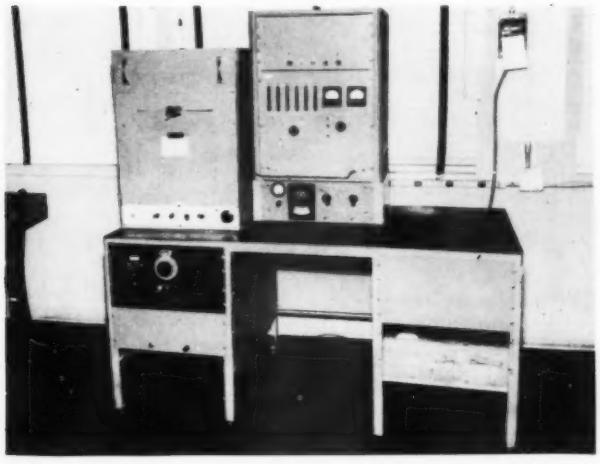
Various types of equipment are chosen for the same kind of exposure to meet various conditions.

TEMPERATURE

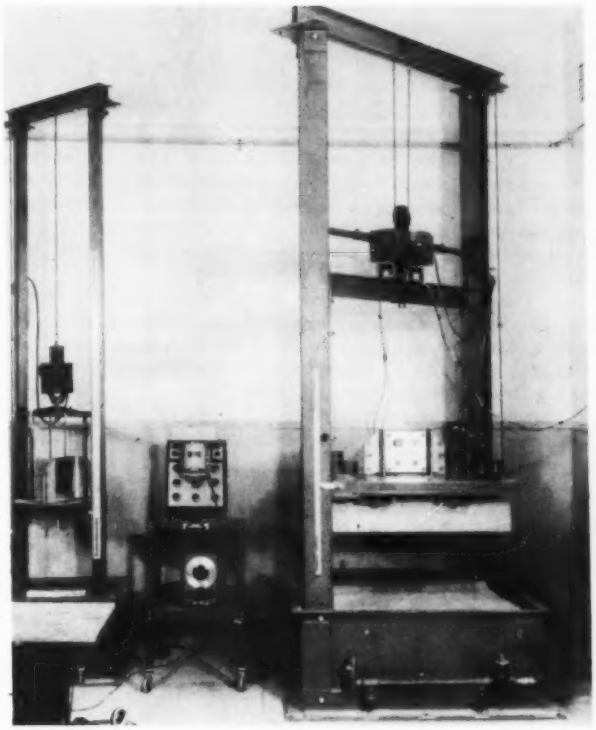
The following temperature chambers are used: (a) *Temperature rooms* – for elevated temperatures only, held at 70C and 113F. The rooms or closets are used for long term storage tests (113F for dry batteries for 3 months) and where the volume of work justifies in the case of common life tests at 40C. (b) *Movable Cabinets – 65 to 85C range.* These are the work horse cabinets of the laboratory built to their own design and are used for all common exposure temperature cycling tests, low temperature operation etc. The cabinet uses dry ice and heaters and is simple, reliable and cheap. (c) *Fixed Cabinets* – 55 to 275C. These are larger cabinets using mechanical refrigeration and used where the dry ice cabinets are not suitable – for example measurement of capacitance charge with temperature for air dielectric capacitance. They are also required where very large components are being tested (i. e. storage batteries) which are beyond the capacity of the smaller cabinets.

HUMIDITY

Humidity cabinets are divided into three classes: (a) *Automatic Cycling Machines* simulating severe tropical exposure. The tests involved are standard military cycling schedules. Two of these machines normally operate 24 hours a day, 365 days a year. Reliability is essential. (b) *Constant Humidity Cabinets* – simulating lesser tropical and temperature climate conditions as favoured by some spec writers. (c) *Incubation Cabinets* – for fungus exposure tests. These are cabinets with constant but moderate conditions of temperature combined with high humidity for incubating fungus test specimens.



Temperature oven, complete with oscillator, frequency counter and controls, tests capacitance coefficients.



A drop-type sandbox shock test, with recording camera, measures the opening of relay contacts during shocks.

SALT SPRAY

The agency has attempted to limit salt spray testing to one procedure using one chamber. The variety of tests now specified may require more chambers with different conditions of temperature and salt concentrations.

The cabinet now used is made of sheet glass and angle iron to QQM-151.

VIBRATION

For low frequency vibration, mechanical vibrators are used in the range 10-55 cps. These machines have capacities from 10 to 100 pounds dead load and are equipped with automatic cycling devices. Both vertical and horizontal mode machines are available. For high frequency vibrations to 3000 cps the laboratory has a magnetic type (speaker type vibrator) with an electronic type driver unit. Proposed additions to these machines are: (a) a circular mode machine, (b) a high weight capacity machine – of the type mfd by LAB Co., (c) a permanent set up for cold vibration to replace the temporary method now used.

Continued on Page 20

SCIENCE SECTION NEWS

We'd like to pass on news of the industry in this section and would appreciate receiving any news you may have about activities or developments within the field.

Mr. Harold Jones of Westinghouse Electric Corporation's Air Arm Division (Baltimore) addressed the N.Y. Chapter on "The Philosophy of Environmental Testing" at its first meeting, Nov. 10, 1955.

Stressing the necessity of a detailed definition of the tests to be performed as a preliminary to the formulation of an intelligent research program, Mr. Jones enumerated the basic principles of successful environmental testing.

Of first importance, he said, was a careful evaluation of the use of the item so that its logical environment might be established and only meaningful tests made. "Take care that in your love of environmental test you are not guilty of testing just for the sake of the test without a real need for the results of the test," he told his audience.

In designing the item, Mr. Jones pointed out, the conditions of a specific environment should be met, rather than a general overall specification. "To some people not thoroughly acquainted with aims and philosophies in environmental testing," he warned, "this would seem an excellent place to attempt to reduce costs by reducing tests below the minimum required level. Guard against this, because if the environmental tests do not thoroughly and accurately reproduce the field environment, trouble will not be averted but will merely be delayed until your units have reached the field—and then the correction of trouble is not only far more costly but leaves a rather sour taste with the customer."

Another point at which the basic philosophy of environmental testing can influence both cost and quality, Mr. Jones stated, was in the distribution of work between qualification tests and sample tests. "When testing is started, be very rigorous on the first production sample tested and then be sure the sample tests are of a strictly quality control value," he urged. "After making all of the required corrections, as indicated by the test results, and after thoroughly testing these changes, it can be assumed that the design and manufacturing processes are good."

Mr. Jones concluded his talk by showing slides of some of the equipment used in the Westinghouse Air Arm Division environmental test section.

"THE ENVIRONMENT"

A- CLIMATIC CONDITIONS
1. HEAT
2. COLD
3. HUMIDITY
4. SALT SEA ATMOSPHERE
5. SAND AND DUST
6. FUNGUS

B- FLIGHT CONDITIONS
1. HEAT
2. COLD
3. ALTITUDE
4. SHOCK
5. VIBRATION

C- OPERATIONAL CONDITIONS
1. RADIO INTERFERENCE
2. GUNFIRE
3. EXPLOSIVE ATMOSPHERE

"Proceedings" Available

The "Proceedings" of the First Annual Science Section Meeting, held in Chicago on April 28, 1955, are now available from Institute headquarters in a limited quantity for $5.00 per copy.

Welcome New Members

Allied Control Co., Inc. (Company Member)
2 East End Avenue
New York City 21, N. Y.

Arthur R. Young
Barber-Colman Co.
Rockford, Illinois

Sol Baker
Allen Aircraft Products, Inc.
Ravenna, Ohio

Irving P. Polak
Marquardt Aircraft Co.
Van Nuys, California

Marvin D. Vance
Lear, Inc.
Grand Rapids, Michigan

A. P. Harris
Canadian Military Electronics Standards Agency
Department of National Defense
Ottawa, Canada

Hudson Bay in New Hands

The ownership of the Hudson Bay Company, Refrigerations Systems, Inc. has been transferred to: Hudson Bay Co., Division of Labline, Inc., 3070 W. Grand Avenue, Chicago 22, Illinois. Mr. William Fahey has been named General Manager by Mr. Alexander I. Newman, President of Labline, Inc.

GET YOUR SCIENCE SECTION

APPLICATION BLANK NOW!!!

Better Products with TENNEY-TESTING

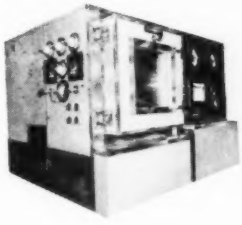
quality improved — costs lowered by advanced environmental testing

TEMPERATURE • ALTITUDE
HUMIDITY • METAL TREATING
WALK-IN CHAMBERS
BATHS • SAND AND DUST
EXPLOSION • FUNGUS

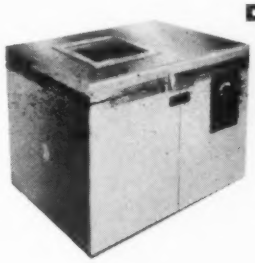
Do your products **really** deliver their rated performances at —100°F... at 150,000 feet altitude... at 95% humidity? Tenney-Testing environmental equipment gives you a complete record of performance under extreme conditions quickly, accurately... eliminates costly engineering and production changes. Environmental testing equipment for simulating **every** atmospheric condition is engineered and manufactured by Tenney. Altitudes to 200,000 feet +... temperatures of —150°F to +500°F... 10% to 100% humidity.

TENNEYZPHERE ALTITUDE CHAMBERS

Custom-engineered to simulate every atmospheric condition from sea level to 200,000 feet +. Temperature range of —150°F to +350°F.* Relative humidity of 10% to 100%. Full instrumentation for constant conditions or program cycles. Sizes from four cubic feet to walk-in rooms.



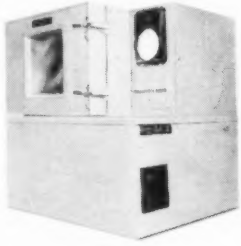
DRY ICE CHAMBERS



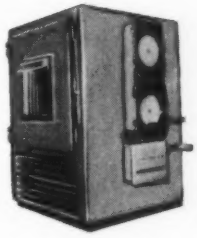
Low cost chamber for product testing, storage, and metal treating. Temperature range —100°F to +200°F.* Automatic control, indicating or recording instrumentation. Easy loading and unloading of dry ice compartment.

TR CHAMBERS

Designed and custom engineered for accurate testing at temperatures of —100°F to +200°F,* with relative humidity 20% to 100%. Recording controlling instrumentation, or program control for MIL specification testing.



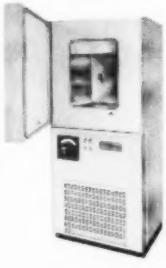
TH CHAMBERS



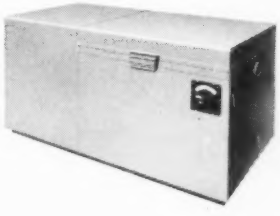
Precision equipment for accurate testing at above freezing temperatures (+35°F to +200°F*) within a humidity range of 20% to 100%. Available with recording controlling instrumentation, or program control for meeting MIL specifications.

TENNEY-MITE

New **low cost** mechanically refrigerated test chamber. 1½ cu. ft. capacity, ideal for laboratories, metal working shops, and testing departments. Temperature ranges of ambient to —40°F, —100°F, —120°F. Table-top or free-standing arrangements. Available as a bath, or as an oven to elevated temperatures.



SUB-ARCTIC CABINETS



For shrink fitting... hardening and stabilizing dies, gauges, and precision parts... research and production testing of electronic equipment, instruments, plastics, lubricants, etc. Wide variety of sizes, with temperature ranges of ambient to —170°F.

Thousands of Tenney Chambers are now in use. Tenney's highly-specialized engineering and design staff — largest in the industry — will analyze your testing problems and develop the most effective solutions.

Write or wire **today** for complete specifications, performance data and quotations on these units or other environmental test equipment.

Member of Environmental Equipment Institute

Engineers and Manufacturers of Refrigeration and Environmental Equipment

Tenney
ENGINEERING, INC.
Dept. EB-6 1090 SPRINGFIELD ROAD, UNION, N. J.
Plants: Union, N. J. and Baltimore, Md.

*Higher and/or lower temperatures available.

NEW PRODUCTS

News of product developments are welcomed by the editors. Send releases to the Environmental Equipment Institute, 30 Church St., New York 7, N. Y.

Low cost 8 cu.-ft. dry ice chamber developed specifically for economical dry-ice cold-treating of metals in metal-working shops, electronic component and instrument plants, laboratories and other organizations which require low cost test facilities.

Temperature range is from –100 to 200F. Reported pull-down is from ambient to –100F in approximately 60 min, while 200F can be reached in approximately 30 min.

The unit plugs into a standard 110-V line, and is equipped with swivel casters for mobility. Temperature control is automatic, and indicating or recording instrumentation is available as optional equipment. Tenney Engineering, Inc., 1090 Springfield Road, Union, N.J.

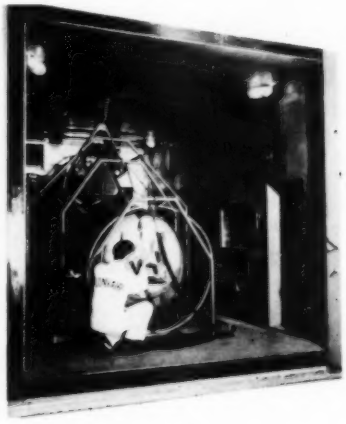
New temperature-altitude chamber is refrigerated by cascade system. Has temperature range from –100 to 250F and simulates altitudes to 100,000 feet. Interior of chamber measures 48" wide by 24" by 24".

Chamber features include: temperature and altitude recorder-controller instrumentation, adjustable climb and dive valves, manometer for pressure-altitude readings, fin-surface cooling coils, an external pressure member, forced air cooling, and cold wall liner.

Chamber dissipates 300 watts at –70F at 65,000 feet. Temperature can be pulled down from 70 to –100F in 45 min. Heating from –70 to 250F, or from –100 to 70F, can be accomplished in 25 min.

Trigger-action locks provide a vacuum-tight door seal, while a lever-action release arm provides for easy door opening. Model FH-16-5-5. Conrad, Inc., Dept. EQ, 141 Jefferson Street, Holland, Mich.

The door of this altitude chamber lowers into the floor. Up-and-down operation is hydraulically controlled; tight closure is provided by pneumatic latches. Chamber is located at Development Laboratories of Water Kidde & Co., Inc., Belleville, N.J. Shown are A. E. Schmidlin (right), in charge of Kidde's aircraft air compressor development program, and John Kapp, project engineer, checking final adjustments on a compressor before starting test run.



Convair engineer begins first test in what is said to be the largest wide-range temperature cell on West Coast. Component being tested is full-size cockpit section of the Air Force's delta wing supersonic F-102A all-weather interceptor. The 2,000 cu. ft. cell, located in Convair's San Diego plant, measures 20' long, 10' wide, and 10' high. Temperatures from –100F to 300F can be produced. A pull-down from 70F to –100F with a test load of 2,000 pounds of steel and 5kw heat dissipation can be made in less than three hours.

The refrigerating system is a direct contact type using liquid carbon dioxide forced through commercial alcohol. The CO_2 is taken from a six-ton tank at 0F and 300 psi. At temperatures as low as –112F, alcohol is pumped through 1300' of 3/4" finned copper tubing.

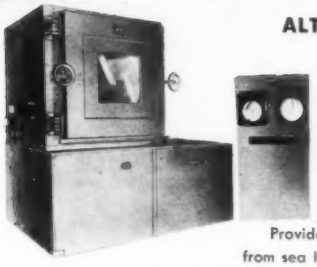
AR

for completely AUTOMATIC

ENVIRONMENTAL TEST EQUIPMENT

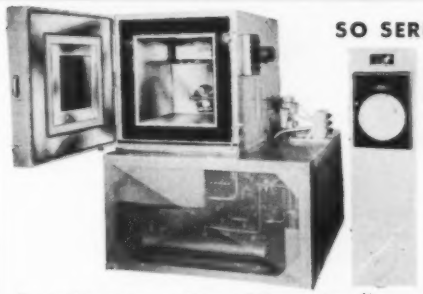
in any combination

ALT SERIES



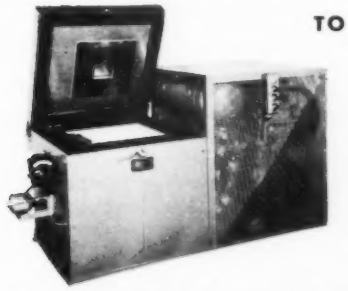
Provides simulated Altitude from sea level to 80,000 feet or higher, Temperatures from −100° F or lower to +500° F or higher, and Relative Humidity from 20% to 95%. Standard models available with rectangular test space from 5 cu. ft. to 64 cu. ft. Features include air circulation, water cooled condensers, safety thermostat.

SO SERIES



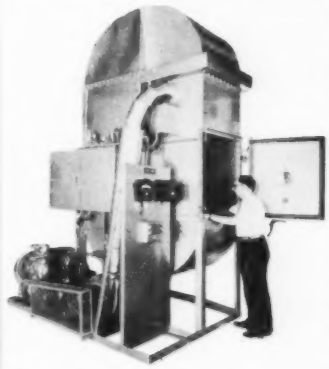
For testing under conditions of Temperature (from −100° F and lower to +500° F and higher) with or without Humidity. Completely self-contained unit has hermetically sealed stainless steel test space from 5 cu. ft. to 64 cu. ft. in standard models.

TO SERIES



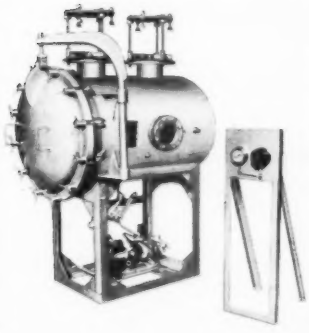
Top opening cabinet for testing, processing or storage at extreme low Temperatures of −120° F or lower. Auxiliary equipment available to produce temperatures as high as +185° F.

SAND & DUST



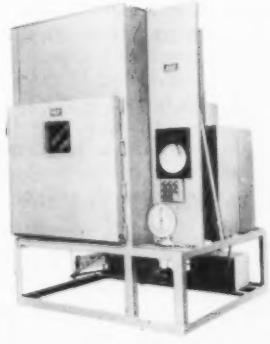
For testing under conditions of Sand & Dust, standard chambers are supplied with test space from 8 cu. ft. to 80 cu. ft. Streamlined design minimizes air side pressure drop. Furnished complete with initial dust supply, factory preset air velocity, and temperature, humidity, air velocity and dust density indicators.

EXPLOSION



The safest chamber available for testing under conditions of explosive atmosphere from sea level to 50,000 ft. Features include air movers to assure adequate circulation of vapors, dual automatic pressure release valves for double the required relief area and complete ignition system, including remote firing station.

RS SERIES



For testing under conditions of Rain and Sunshine. In Sunshine Test, provides radiant energy of 100 W to 140 W per sq. ft. with temperature maintained at 45° C. In Rain Test, water is emitted in small drops at rate of 4 inches ±1 in. per hour, with temperature maintained between 11° C and 20° C. Chamber temperature maintained between 20° C and 30° C.

Also manufacturers of Fungus, Central Brine, Special Liquid Chilling and other types of Environmental Test Equipment.

AMERICAN RESEARCH CORPORATION

22 BROOK ST. • BRISTOL, CONNECTICUT

Continued from Page 9

The application of these refrigerants permit employing commercially available refrigerant components, including refrigerant control valves, providing care is taken in the selection and location of the control valves. Control valves normally employed are thermostatic expansion valves, automatic expansion valves, float control valves and, in certain cases, capillary tubes.

Satisfactory performance of the refrigeration depends to a great extent on preventing oil from congealing in the refrigerant control valves or cooling coils. Therefore, automatic oil separators are recommended for the Freon 13 system in every case, and for the Freon 22 system in many cases. Synthetic oils and lubricants have been used on some installations, but the stability of this type of lubricant is not ideal. A 150 viscosity wax-free oil is proven to be acceptable, providing oil separators are installed in the system.

The cascade condenser design also has considerable effect on the success of the installation. The condenser should be generously sized for the following reasons: more rapid condensing of Freon 13 refrigerant at the start of the cooling cycle, more efficient performance from the Freon 22 system, and resulting lower discharge pressures on the Freon 13. The lower the discharge pressure maintained on the Freon 13 system, the more efficient the system at the lower temperatures. Several designs are currently in use for these condensers, such as shell and tube and tube-within-a-tube heat exchanger type. The tube-within-a-tube arrangement for the condenser quite often is more convenient for small test chambers, due to space limitations.

Cooling coils suitable for Freon 13 – Freon 22 refrigeration systems are the conventional type refrigerated wall surface, refrigerant plates, copper tube with extended-fin surface, etc. Many "cold soak" chambers are suitable with only cold wall cooling. Chambers which must have a good capacity for product cooling or absorbing "live load" heat dissipation should be equipped with extended-fin surface cooling coils singularly, or in conjunction with cold soak cooling. Altitude chambers are most efficiently cooled through the use of cold wall cooling in conjunction with extended-fin surface cooling coils.

The important consideration in cooling coil design, aside from the ability to absorb the required amount of heat, is a careful arrangement to prevent oil trapping and, in many cases, to prevent trapping out Freon 13 refrigerant. Care must also be exercised with regard to the length of each cooling coil circuit to keep pressure drop to a minimum and also to permit even distribution of refrigerant. Assuming the equivalent of 5/8" tubing passage, ideal circuit length should be approximately 40 to 50 feet.

Color-coding of the Freon 13 and Freon 22 systems is very helpful to service and maintenance personnel. Blue has been used quite universally to identify Freon 13 systems, and green to identify Freon 22 systems. Electrical equipment should be grouped together in an electrical compartment box and the panel wired for easy inspection whenever possible.

In summarizing, it can be stated that the Freon 13 – Freon 22 systems can produce temperatures to -100F with total horsepower 50% to 60% less than otherwise would be necessary with a compound system of Freon 22 only. Due to the resultant saving in horsepower and more compact designs, more applications for the system are becoming evident regularly. Among these, in addition to the environmental test chamber uses, are low temperature storage cabinets for virus, semen, metal treatment, oil testing chambers for cloud and pour points, shrinking of bearing inserts, stabilizing of gages, tools and dies, condensing industrial gases to permit storage in liquid chillers, portable air chillers, and gas dryers.

QUESTIONS & ANSWERS

The Questions & Answers column will be a continuing feature of your Environmental Quarterly. Address questions and answers to the Environmental Equipment Institute, 30 Church St., New York 7, N.Y.

Question:

What are the best methods for cleaning test specimens after being subjected to a fungus test (MIL E 5272A)? What are the best protective measures for personnel handling such test specimens?

H. F. Sander,
Vapor Heating Corp.

Answer:

There are several methods, the one to be used depending upon the nature of the test specimen. The best method is to subject the specimen to autoclave sterilization if it can stand this treatment. Decontamination is internal as well as external.

If the test specimen cannot be subjected to superheated steam, as is usually the case, one of the three following methods may be used: (1) Swab or soak the specimen in 85% ethyl alcohol; (2) wash thoroughly with soap and water; (3) swab or soak the piece in phenol solution.

With regard to protective measures for personnel, actually the danger is not too great and common sense laboratory technique is all that is necessary. It is well to make sure that the cultures or test specimens remain isolated and personnel should wash their hands after handling and should avoid contact with their clothing.

William Tonkowich,
General Testing Labs., Inc.

Can you answer this one? Answers will be published in the next issue.

Specification MIL-T-12679A (Transistors, Crystal Diodes and Related Semiconductor Electronic Devices) requires a 500g shock test of approximately one millisecond deviation in accordance with Method 202 of MIL-Std-202. This method specifies the JAN-S-44 shock machine.

What would be the spring constant and is one available to produce the specified shock on this shock machine?

E. S. Brown,
Standard Cabinet Co.

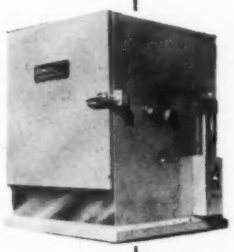
BEMCO STANDARD AND CUSTOM BUILT ENVIRONMENT TEST EQUIPMENT

W Series

LOW COST HIGH HUMIDITY TEST FACILITY

Specifically designed for high humidity testing in accordance with MIL-E-5272-A, Procedure 1 and 3.

Model	Test Space
W-8	24"x24"x24"
W-27	36"x36"x36"



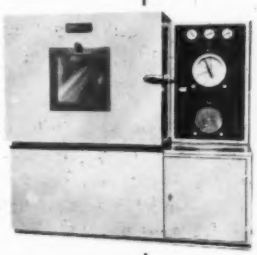
WF Series

TEMPERATURE AND HUMIDITY CHAMBERS

Dry bulb temperature range from —100 F. to +500 F.

With or without controlled humidity is now available in a standard unit.

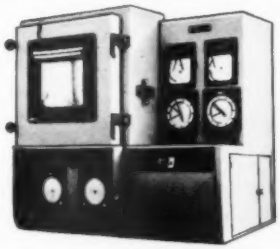
All heli-arc welded stainless steel interiors.



WFA Series

STANDARD ALTITUDE CHAMBERS

Temperature:
—120 F. to + 300 F.
Relative Humidity:
20 to 95%
Altitude:
Site to 150,000 Feet
Using Compound Freon 22 or Cascade Freon 13 systems welded and pressure checked inner and outer liner to insure vapor proof seal.

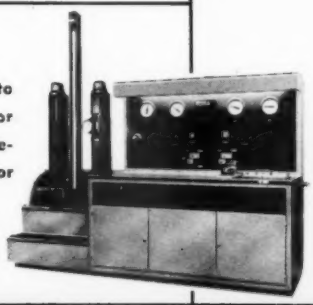


D F Series

DRY ICE CHAMBERS

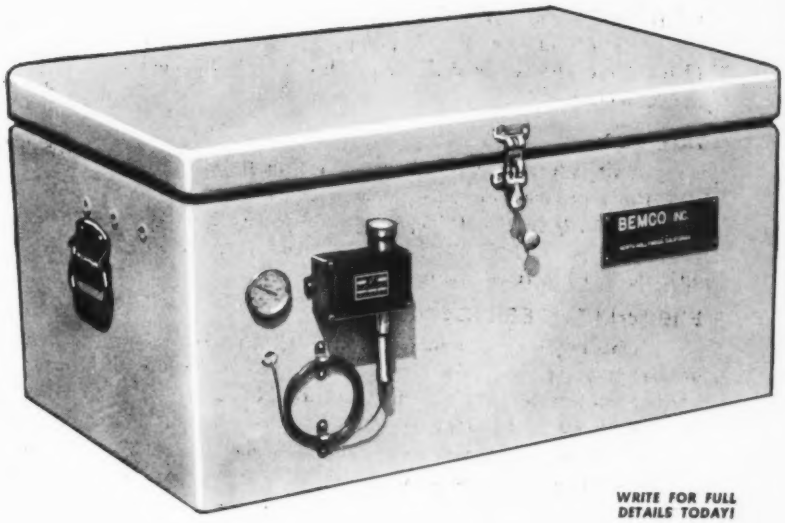
These units are designed for high performance in the variable range of —100 F. to +200 F., are available with or without relative humidity.
Capacity of dry ice section is sufficient to hold —100 F. test temperature over a week-end.

We will design to your specification or fabricate to your design any hydraulic or pneumatic bench equipment.



DRY ICE, HIGH AND LOW TEMPERATURE CHAMBER

BEMCO MODEL EDF-100-1



WRITE FOR FULL DETAILS TODAY!

Small, portable, accurate high & low temp. testing box

Mass production from special dies. Immediate delivery from stock.

Designed for the individual engineer: Does not tie up your larger equipment.

Holds a 50-lb. block of dry ice. Is ducted to balance heating and cooling without wasting dry ice.

Temp. range: —100 F. to +200 F. control ± 2 F.

Wt. 60-lbs. uncrated.

Test space: 10" long x 17" wide x 11" high.

Overall dimensions: Length, 20" plus motor
Width, 32"
Height, 16½"

BEMCO, INC. 11111 CHANDLER BOULEVARD NORTH HOLLYWOOD, CALIFORNIA

Continued from Page 13

SHOCK

Shock equipment requirements fall into three categories as follows: *Low Impact* – (to 50g). To achieve low impact shocks two basic machines are used; the "guillotine" a JAN-S-44 machine, and the "Sand Box" type machine as designed by the Barry Corp. Some specifications call for dropping the item into a hard plank from a fixed height. *Medium Impact* – (to 200 g). To obtain medium impact shocks the sand box type machine is used exclusively. *High Impact Shock* –(to 200 g). The light-weight hammer and anvil machine to specification MIL-S-901, fills this requirement.

This equipment does not cover all requirements which arise, particularly those involving medium shocks with a long drag time.

ALTITUDE

Altitude equipment is of three types: (a) simple low pressure machines to cover the common requirements to 55,000 feet, (b) special bell jar equipment to cover altitudes of 100,000 feet and over, (c) combined altitude and low temperature cabinets.

EQUIPMENT SPECIFICATIONS

While space does not permit a complete listing of requirements for environment chambers there are some general requirements which are essential for equipment in a program of this nature.

Reliability is paramount. It is not economical to purchase cheap equipment where several years of continuous operation is required. In general, it is better that the equipment be somewhat overdesigned so that rated conditions can be met without strain on the pumps, compressors, motors and other moving parts. Since most machinery is made outside of Canada and, therefore, repair and maintenance service is hard to come by it is particularly desirable that equipment be trouble free. The clinching argument is perhaps that down-time on some apparatus is worth $200 a day.

Construction features must include adequate insulation, proper sealing and the use of stainless steel throughout. It is regrettable that some manufacturers still attempt to use dissimilar metals where humidity is present.

Instruments and controls must be accurate, fool proof and trouble free. Instruments are a weak point with some manufacturers' products.

Automatic functioning can pay for itself in a few months where operation is continuous provided the added complexity does not reduce reliability.

Electrical terminations and connections to the chamber are inadequate in many equipments. Both high and low voltages must be provided for and at least 36 terminals are required. These terminals must have a high insulation resistance under all conditions.

Safety is sometimes sacrificed for economy or overlooked in the design. Wiring codes must be strictly adhered to. Grounding is imperative. The mechanical structure of pressure chambers must include generous safety factors. Instruments must be shock proof.

A most desirable feature are overload devices which will shut down the equipment when normal controls fail. These devices must be coupled with a warning device to indicate failure. This is particularly important on high temperature cabinets where considerable difficulty has been experienced with thermostatic controls.

LABORATORY OPERATION

The laboratory performs tests only as requested by the Agency and is responsible for testing operations including custody of samples and equipment, test procedures when not specified and accuracy and clarity in reporting. Liaison with the laboratory is close.

REPORTS

As there are several laboratories engaged by the Agency, a standard form of reporting results is essential. Basically it has the following sections: (1) a section with an abstract and brief statement of the purpose and authorization for testing, (2) A section describing the item and the general results, (3) A summary of performance on one page, (4) A section describing the method of test and the equipment used, (5) A section showing the detailed test data and actual readings. The identification of the item is deliberately detailed and photographs are normal. These extras have paid off in clarity, ease of interpretation, and confidence in the report by both the military and industry.

SECURITY OF INFORMATION

For the protection of the manufacturer, all test reports and test data is considered as confidential between the Armed Services and the manufacturer. The laboratory will not release information without the specific approval of the Agency. Manufacturers who wish to observe how tests are performed may observe tests on their particular product at the convenience of the laboratory.

OPERATION

The laboratory charges a fixed rate per man hour which includes labor and overhead. The overhead costs cover maintenance, depreciation, services etc. is approximately equal to the labor costs. This is also true for other laboratories used for similar work. Not included is depreciation in a certain amount of the capital equipment owned by the military.

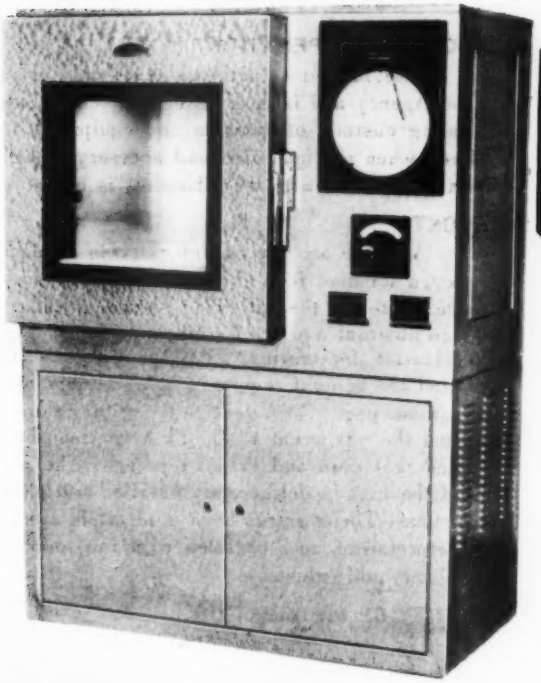
The Agency normally purchases high-cost, limited-use items peculiar to the testing operation. This is done so that in the event that the contract is changed or ceases the laboratory is not left with a great deal of equipment which is useless to it.

Continued on Page 22

CABINET MODEL CHILLING CHAMBERS

by

HARRIS REFRIGERATION CO. inc.



6 to 50 cubic foot capacity

accurate temperature control from -100°F to +200°F

Many applications in . . .

- **LOW TEMPERATURE RESEARCH**
  Component and material studies
- **INDUSTRIAL METAL-WORKING**
  Hardening, stabilizing, and shrink-fitting
- **ENVIRONMENTAL TESTING**
  Prototype and production tests
- **MEDICAL REFRIGERATION**
  Blood and bone storage

Performance . . .

The Harris chilling chambers are specially designed for environmental testing. The upright cabinets provide convenient accessibility and observation during tests on small components, instruments, and samples. Chamber temperatures can be held continually at any point within the entire -100°F to +200°F range. Thermostatic control is accurate to ±1°F, and constant temperature is maintained throughout the chamber by a specially designed fan. Temperature pull-down time from ambient to -100°F is 50 minutes. When hot environments are required, temperatures of +180°F can be attained in 30 minutes.

HARRIS

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UNiversity 4-4000

Continued from Page 20

DEPRECIATION

Depreciation is a difficult problem both from the costing and planning standpoints. The average life of equipment is five to six years and is not simply a case of wearing out but of functional obsolescence. The requirements of the Services are becoming more and more severe. Electrical tolerances are being tightened and new and more environmental conditions are being introduced. These changes are not predictable. Equipment does therefore have to be discarded before reaching the end of its useful life.

Unless considerable care is taken with expensive equipment, both operational and depreciation costs become very high particularly when the test requiring the equipment is new. Consider the case of an item of environmental equipment costing $25,000 purchased to perform a new operational test. The use of the equipment in the first year may be restricted to six tests at 4 hours each for approximately 25 hours of actual use. The write-off may be as high as $5,000/year indicating $200 an hour operating cost (plus a small extra fee for space, services and maintenance). The laboratory may be faced with the uncomfortable situation of charging the customer $600 for a three hour test which is only part of a complete test.

The partial solution to this problem is to purchase equipment of greater capabilities than are originally required and equipments which are so mechanically designed and equipped that their versatility is greater and their life so extended.

MAN-HOURS

The man hours required to test one submission of samples of one type are as follows. This is a partial listing: Relays, 150 man hours; Rotating Electrical Machinery, 150; Tube Sockets, 150; Capacitors, all types, 140; Batteries, storage, 130; Crystals, Quartz, 120; Meters, 115; Resistors, all types, 110; Switches, all types, 110; Fuses, 100; Wire and cable, all types, 95; Connectors, all types, 90; Plastic Materials, all types, 75; and Batteries Dry, 40.

With figures of this type the number of technicians required for a particular program can be predicted.

Supervisory time, directly in the laboratory, and administrative time, through the various grades of management, varies widely from laboratory to laboratory. The number of qualified engineers deemed necessary is small and with the principal laboratories a qualified professional engineer spends only a portion of his time in the operation. The actual load is carried by a qualified Technical Officer.

For overall estimating purposes, an extra 10% is added to the man-hour figures shown to cover supervision and administration.

NEW LITERATURE

News of available new literature of interest to those in the environmental field is welcomed by the editors. Send new bulletins and/or news releases to the Environmental Equipment Institute, 30 Church St., New York 7, N. Y.

•

Dynamic Accuracy Tester is covered in new 4-page bulletin. Describes facilities for ground testing complete armorment systems at GE's all-angle environmental firing range. Includes brief section on shock and vibration testing. Bulletin GEA-6345. Available from General Electric Apparatus Sales Division, Schenectady 5, N.Y.

•

Correlation of Natural Weathering and Sheltered Storage Exposure Tests With Simulated Environmental Laboratory Tests. 50-page technical report prepared for Wright Air Development Center by South Florida Test Service. Available from Wright Air Development Center Research and Development Command, United States Air Force, Wright-Patterson Air Force Base, Ohio.

•

Independent Environmental Testing facilities covered in nine-page brochure. Includes list of 20 types of environmental tests undertaken. Illustrations and text cover equipment and personnel and indicate tests which can be carried out with various pieces of equipment. General Testing Laboratories, Inc., 58 Washington Avenue, Carlstat, N.J.

•

Metal Chilling and Product Testing Equipment. 12-page, two-color bulletin includes information on shrunk-fit assembly of metal parts, metal treatment through chilling, gas dehydration and metal and material testing. Illustrates and specifies seven models of chilling machines and four models of industrial temperature testing units. Technical data includes charts of typical cycles in heat treatment and sub-zero treatment of water and oil hardening tool and other steels. Separate charts are provided for high-speed and Moly-type steel processing, as well as chill-treating steel for complete stabilization. Cincinnati Sub-Zero Products, Reading Road at Paddock, Cincinnati 29, Ohio.

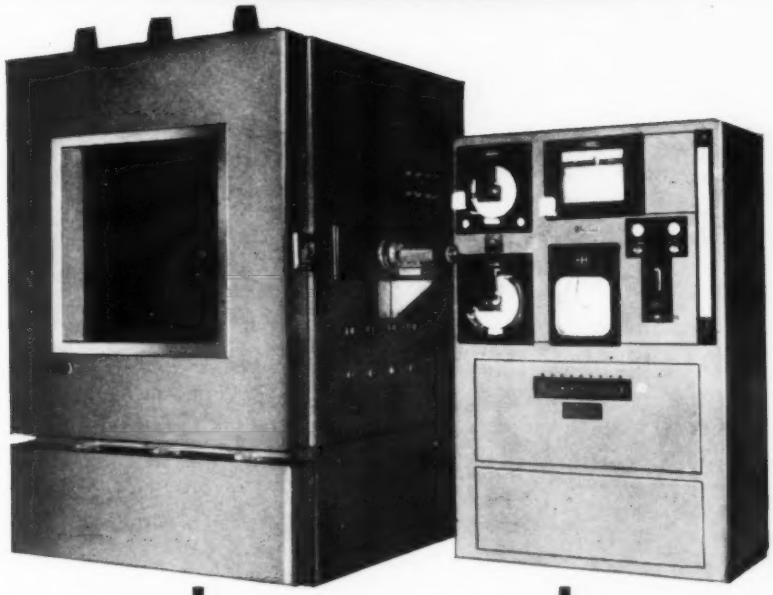
•

12 Cu. Ft. Upright Cabinet is covered in new catasheet. Cabinet provides close control of temperatures between –130 to 250F. Harris Refrigeration Co., 365 Waldon St., Cambridge 38, Mass.

CONRAD, Inc.

HOLLAND, MICHIGAN

ENVIRONMENTAL TEST CHAMBERS



TEMPERATURE CABINETS

Two Types
"F" Series — Front Opening
"C" Series — Top Opening

Range:
−150° F. to +500° F.

Size:
4 cu. ft. to 72 cu. ft.

HUMIDITY AND TEMPERATURE CABINETS

"F" Series — Front Opening

Range:
−150° F. — +500° F.

Humidity:
10% to 97%
Controlable above a 35° F. D.P.

Size:
4 cu. ft. to 64 cu. ft.

ALTITUDE AND TEMPERATURE CABINETS

"F" Series — Front Opening

Range:
Temperature:
−150° F. — +500° F.

Altitude:
Up to 125,000 ft.

Size:
4 cu. ft. to 64 cu. ft.

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RAPID CHILLING **FULLY AUTOMATIC OPERATION**

NEW LOW TEMPERATURE TECHNIQUES

affect you if you are engaged in the following -

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- ★ Chemical curing, ageing, and processing.
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- ★ Laboratory testing.
- ★ Biological laboratories and hospitals.
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- ★ Rubber processers.
- ★ Scientific navigation; aeronautical instruments.
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- ★ Engine and precision machine manufacture.
- ★ National physical health service.
- ★ Scientific and fundamental research.

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FOR PRODUCTION LINE

. . . If it's low temperature equipment

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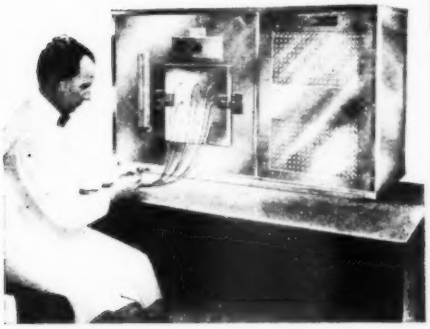
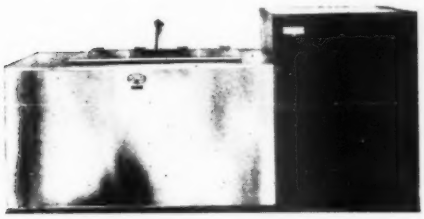
TRADE-MARK REG. U. S. PAT. OFF.

makes it!



Webber High-Low Temperature Bench Unit



Webber Low Temperature Production Line Unit

From the smallest testing units to large capacity industrial cabinets there's a WEBBER Low Temperature Unit to fit your needs and applications. Units with temperatures to −185° F. are available with heat cycling, humidity and vacuum for testing.

Industrial Units are made in a variety of sizes and shapes. Its custom equipment at standard equipment costs. Special patented features assure faster heat removal, low cost operation and safety factors.

For low-temperature equipment . . . for guaranteed dependability and performance . . . *see* WEBBER.

WEBBER

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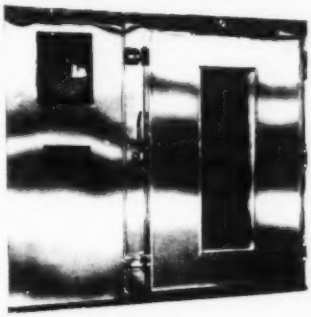
WEBBER CASE HISTORY

No. 237
WESTINGHOUSE CORP.

TEMPERATURE and Humidity Control . . .

features of Webber Environmental Test Unit!



Webber designed *fully automatic control* of temperature *and* humidity into this test unit for Westinghouse Electric Corp., Pittsburgh.

While this unit required control from —80 F. to +200 F. and 20%-90% relative humidity, Webber can provide a complete *high-low* temperature and humidity control range. Webber designs and manufactures a full line of Standard Environmental Test Units, as well as special application equipment.

If you have an Environmental Test problem of *any* kind, Webber Engineers *want* to be of service to you. Send coupon for brochures on new Chest-Type Unit and Environmental Test Equipment.

Write today and give us your request . . . for engineering assistance, quotations, your specifications, or your order.

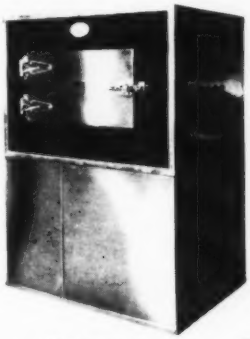
WEBBER CASE HISTORY

No. 286
LANSDALE TUBE CO.

Automatic Cycling

with temperature range from −100f to −200f

. . . helps Lansdale Tube Company produce quality radio and television tubes



Webber designed and built this Environmental Test Unit to rigid customer specs. Extreme accuracy was required in controls automatically changing temperature from —80F to +185F and return—on an hourly cycle.

Webber manufactures a complete line of standard Environmental Test Units, featuring high-low temperature range and optional humidity control. Webber designs *all* types of special Environmental Test Equipment, and manufactures it to *your* specifications.

Webber engineers *want* to be of service to you. Whatever your high-low temperature test problem, write today giving your specifications, requests for assistance or quotation, or your order!

Send coupon below for helpful new literature.

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NEWS NOTES

DU PONT PREDICTS FUTURE ENVIRONMENTAL TEST TEMPERATURES FROM –250 TO 600F

At a speech before the American Society of Mechanical Engineers in Chicago, Mr. R. C. McHarness of Du Pont's "Kinetic" Chemical Division stated that, "the temperature range of environmental chambers has been expanding until today people are considering the feasibility of chambers that will cover the range from –250 to 600F."

Mr. McHarness pointed out that there is available thermodynamic data on at least 25 potential refrigerants with boiling points exceeding 400F, offering a distinct challenge to engineers in developing new equipment for extending the range of mechanical cooling.

As an example of recent accomplishments he stated that more versatile metals with added ability to withstand higher temperatures might be obtained through use of low temperature quenching. He pointed out that such processing already has proved important in production of certain types of steel where the crystal structure of the metal can be controlled by refrigeration to obtain much better dimensional stability.

Cascade refrigeration systems employing "Freon-13" and "Freon-22" have been used successfully in low temperature applications while a compound system using only "Freon-13B1" has been operated successfully at temperatures as low as –130F.

ETL EXPANDS FACILITIES FOR ELECTRONIC TESTING

Electrical Testing Laboratories, Inc., New York independent testing laboratory, announces the expansion of its electronic testing facilities. Of particular significance is its ability to conduct tests and engineering investigations well into the microwave regions.

One of the Company's 13 other laboratories is an environmental laboratory, thus enabling electronic testing under diversified environmental conditions.

Typical items on which the laboratories can conduct complete electronic tests under various environmental conditions include: transistors, microwave systems (wave guides, slotted sections, attenuators, frequency meters, etc.) power supplies, transformers, capacitors, resistors, tubes, AM and FM transmitters and materials such as ceramics, plastics, laminates, rubber and other insulators and dialectics.

WHY BECOME A MEMBER OF SCIENCE SECTION OF THE EEI?????

We will tell you. Environmental test is your chosen field, so doesn't it make sense to join with others who are also in the field and may have problems similar to yours? We think it does. Through the annual meeting, the "Environmental Quarterly", and the "Handbook of the Environment", the Science Section is pledged to bring you the type of information you need in a form you can readily use.

Ours is a young organization and the people who join now will have the rare opportunity of being able to help form the organization so that a maximum of benefit can be derived by all. Join now - you need the Science Section and it needs you. Application blanks can be obtained from:

Environmental Equipment Institute
30 Church Street
New York 7, N.Y.

Important

The Quarterly of the Science Section of the Environmental Equipment Institute will be the general publication of the Institute. It will contain semi-technical articles which will present items of interest to all those concerned in the purchase and operation of environmental equipment.

The primary function of these articles will be to bring about a wider dissemination of "tricks of the trade" which have been developed by individuals in the trade, and to keep the membership up to date with new developments.

The Quarterly will also serve as the newsletter of the Science Section of the Institute with reports of activities, notices of meetings, and personal notes. It will be the medium for the exchange of ideas through the publication of letters from the members. In short, it will be a magazine aimed for the benefit of all, the neophyte as well as the skilled environmental test engineer.

It will be the objective of the Quarterly to concentrate into one publication all the information on environmental equipment and testing presently distributed among the many existing periodicals. This will be accomplished by the publication of new technical articles, abstracts of articles published in other periodicals, and book reviews.

In order to carry out this goal, it would be desirable if all members would send in to the Environmental Equipment Headquarters a review of any and all articles that they feel should be published in this magazine.

Please have the following companies send me: New Literature....., New Product Information....., Information on Equipment Supplied to the Field....., as covered in the ads and editorial columns of this issue. (List companies)

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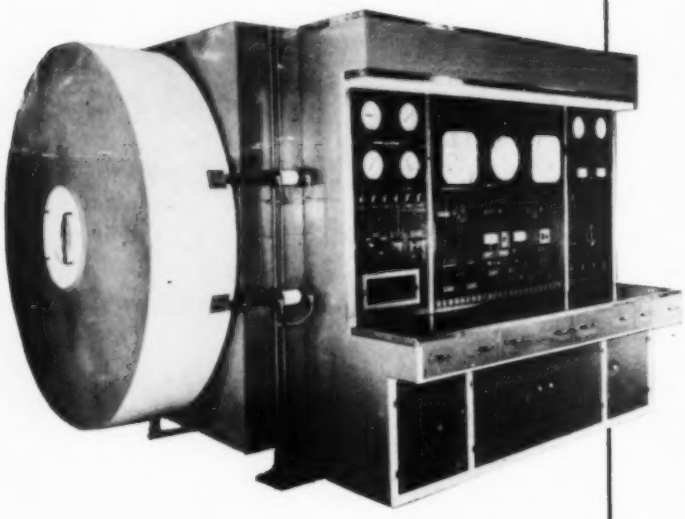
The test engineer knows **RELIABILITY** of test equipment is as important as the of the product being tested. An *"aborted"* test can cost more in time and labor than the initial cost of the test equipment. Why not purchase your environmental test equipment from

ENVIRONMENTAL SPECIALISTS



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Research on simulation of new or more extreme environments. Development of improved environmental specifications for Military Services.

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A natural outgrowth of our testing and research activities was design and manufacture of special environmental test equipment designed from the viewpoint of the user of such equipment.

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Inland's design engineers are intimately familiar with the operation and maintenance problems of the Environmental Test Engineer because they have experienced those problems as Environmental Test Engineers. Consequently, primary emphasis is placed on—

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LIMITATION AND EASE OF MAINTENANCE
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